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United States Utility Patent Application

of

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for

DIFFERENTIALLY-EXPRESSED CONIFER cDNAs, AND THEIR USE IN IMPROVING SOMATIC EMBRYOGENESIS

CROSS-REFERENCE TO RELATED APPLICATIONS

[001] This patent application claims benefit of priority of provisional application U.S. Ser. No. 60/239,250, filed October 11, 2000, and claims benefit of priority of provisional application U.S. Ser. No. 60/260,882, filed January 12, 2001.

FIELD OF THE INVENTION

[002] The present invention relates to a relational database of cDNA molecules, including those corresponding to Loblolly Pine Major Intrinsic Protein (MIP), which are differentially expressed during plant embryogenesis. The present invention further relates to the use of DNA arrays for evaluating gene expression in somatic and zygotic embryos. The invention encompasses related nucleic acids, proteins, antigens, and antibodies derived from these cDNAs as well as the use of such molecules for the staging, characterization, and manipulation of plant embryogenesis, in particular conifer embryogenesis. The cDNAs and related nucleic acids, proteins, antigens, and antibodies derived from these cDNAs are useful in the design, selection, and cultivation of improved crops, specifically including coniferous trees, which provide raw materials for paper and wood products.

BACKGROUND OF THE INVENTION

[003] The world demand for paper is expected to increase nearly 50% by the year 2010 (McNutt and Rennel, *Pulp Paper Intern* 39: 48 (1997)). The United States' forest products industry faces a great challenge in order to keep pace with the growing demand for paper. This challenge is made greater by the decreasing availability of a forest land-base, resulting from environmental restrictions and urban growth, from which to harvest timber resources. Additionally, valuable wood resources are lost to the

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environmental stresses and biotic diseases. Consequently, the push to secure a renewable and sustainable source of raw material for paper and other wood related products has become an important priority for the forest products industry.

[004] Current forestry related research and development is focused on creating sustainable fiber farms or tree plantations. Farming trees with elite germplasms will increase growth rates and yields of wood per acre. However, creating improved tree stock requires the ability to identify and generate genetically superior trees and a way to propagate such superior trees without diluting their genetic quotient.

A. Breeding and Selection

[005] Addressing the need to propagate genetically superior trees without genetic diminution demands full research attention. Traditional methods of tree propagation relied on selected breeding programs to achieve genetic gain, i.e., the development of a strain, sub-strain, or line having any heritable and economically valuable characteristic or combination of characteristics not found in the parents. Based on the results of progeny tests, superior maternal trees are selected and used in "seed orchards" for mass production of genetically improved seed. The genetic gain in such an open-pollinated sexual propagation strategy is, however, limited by the breeder's inability to control the paternal parent. Additional gains can also be achieved by control-pollination of the maternal tree with pollen from individual trees whose progeny have demonstrated superior growth characteristics. Nevertheless, even under controlled conditions where both parents of each seed are the same, sexual propagation results in a "family" of seeds, i.e., siblings, comprised of many different genetic combinations. As not all genotype combinations are favorable, the genetic gain

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